

Second record of the genus *Troglokhammouanus* Lourenço 2007 from Laos, with the description of a new species (Scorpiones: Pseudochactidae)

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Abstract — A new species of scorpion belonging to the genus *Troglokhammouanus* Lourenço 2007 (family Pseudochactidae) is described on the basis of a female collected in Tham Nam Lot cave, Khammouane Province, Laos. This represents the second known record of a scorpion of the genus *Troglokhammouanus*, which is only known from Laos.

Key words — scorpion, Laos, Khammouan plateau, karst cave system, *Troglokhammouanus*, new species

Introduction

As already outlined by Lourenço (2007a), the discovery and description of *Pseudochactas ovchinnikovi* Gromov 1998 from an isolated mountainous region of southeastern Uzbekistan and southwestern Tajikistan, in Central Asia, was considered remarkable. This species displays several unique characters among recent (extant) scorpions, including a distinct trichobothrial pattern and a number of other characters. Besides a combination of features shared with buthid and non-buthid scorpions, Gromov (1998) noted several unique characters of *Pseudochactas* that warranted the creation of a new monotypic family, Pseudochactidae Gromov 1998. Subsequent authors have not reached a consensus regarding the phylogenetic position of this enigmatic scorpion. On the basis of the peculiar trichobothrial pattern of *Pseudochactas*, Fet (2000) suggested a relationship to the most plesiomorphic Buthidae C. L. Koch 1837 or to Chaerilidae Pocock 1893. Lourenço (2000) placed *Pseudochactas* in a new superfamily, Chaeriloidea Pocock 1893, implying that he considered it to be the sister-group of *Chaerilus*. Although there is widespread agreement that *Pseudochactas* occupies a basal position within recent scorpions, its precise phylogenetic position remains a matter of debate (Fet et al. 2004). In an exhaustive study of *P. ovchinnikovi*, Prendini et al. (2006) concluded that the most plausible position for this ‘living fossil’ was as the sister-group of Buthidae. In a recent paper by Sharma et al. (2015), the authors strongly supported the monophyly of pseudochactids, chaerilids and buthids. The precise relationships among these three families, remain however strongly ambiguous.

Another controversial aspect surrounding the pseudochactid lineage concerns its time and region of origin. Fet et al. (2004) speculated about a possible Pangaeen

origin (Permian-Triassic), while Prendini et al. (2006) estimated that, given the family’s restricted geographical range and basal phylogenetic position, it should be considered as a palaeoendemic, a relict of an earlier scorpion fauna living in a more mesic environment. Finally, the discovery of a second element belonging to the pseudochactid lineage, *Troglokhammouanus steineri* Lourenço 2007, in Laotian limestone caves re-opened this question (Lourenço 2007a).

Only a few years after the discovery of this new genus and species of pseudochactid in Laos, more remarkable surprises came from caves in Vietnam, with the discovery of another new genus and species of pseudochactid, *Vietbocap* Lourenço & Pham 2010 (Lourenço & Pham 2010). Subsequently, two additional species were described in *Vietbocap*, from Vietnam and Laos, and the genus was placed in a new subfamily, Vietbocapinae Lourenço 2012 (Lourenço 2012; Lourenço & Pham 2012).

Recent examination of a further specimen collected in Tham Nam Lot Cave, Khammouane Province in Laos (Figs. 1–2) allows to the characterization of a new species of *Troglokhammouanus*, which is described here.

Since most aspects concerning the controversial phylogenetic position of the family Pseudochactidae, in association with biogeographical conjectures, were largely discussed in previous papers, these will not be further debated here. Readers can refer to Lourenço (2007a) for complete references.

Methods

The scorpion was collected in the cave with the help of standard electric frontal lights. It was found between cave walls and clay floor, approximately 350–450 m from the main cave entrance (Fig. 3). Measurements and illustrations were made using a Wild M5 stereo microscope with a drawing tube and an ocular micrometer. Measurements follow

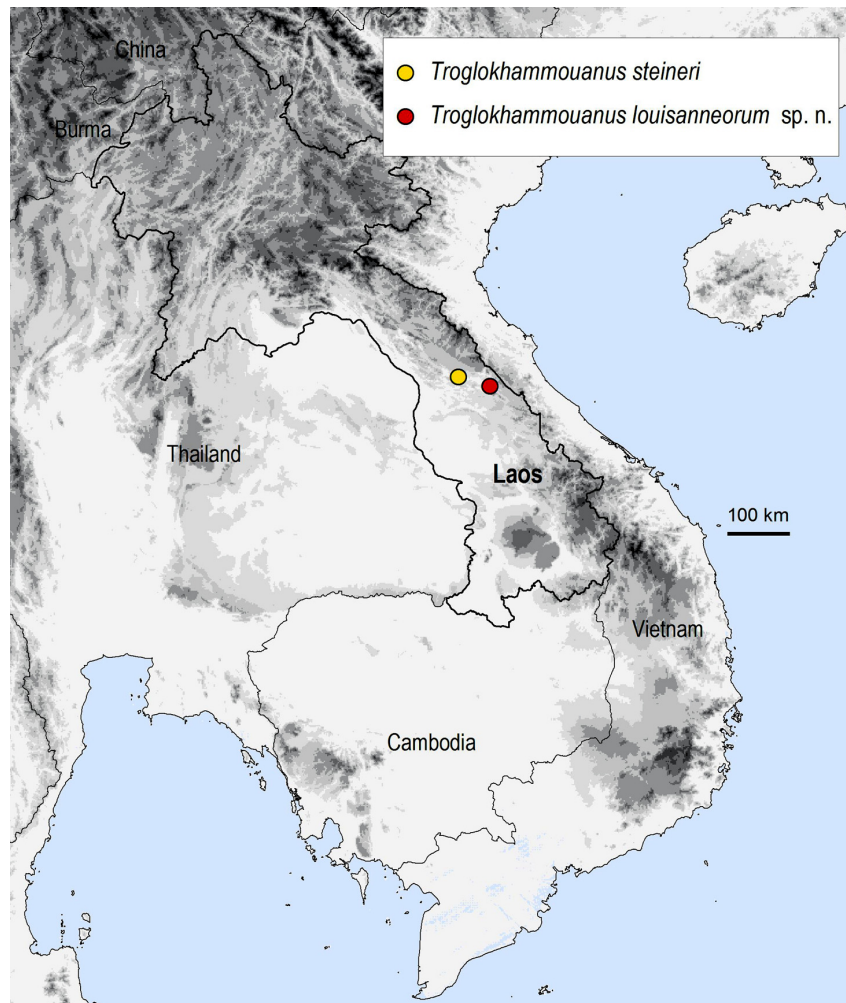


Fig. 1. Map showing the location of the caves where *Troglorhammouanus steineri* and *Troglorhammouanus lousanneorum* sp. n. were collected in Laos.

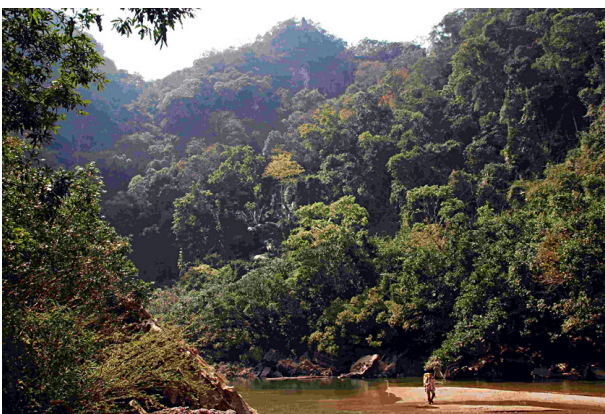


Fig. 2. Typical vegetation in the Khammouane Province, Laos (photo H. Steiner).

those of Stahnke (1970) and are given in mm. Trichobothrial notations are those developed by Söglad & Fet (2003a) and the morphological terminology mostly follows that of Hjellev (1990) and Lourenço (2007a, b).

Taxonomic Treatment

Family Pseudochactidae Gromov 1998

Genus *Troglorhammouanus* Lourenço 2007

Troglorhammouanus lousanneorum sp. n. (Figs. 4–16)

Type material. One female holotype (since these cave scorpions remain extremely rare). Laos: Khammouane: Ban Naden: Tham Nam Lot cave (17.504969 N - 105.385598 E), alt = 176 m, 350–450 m from main cave entrance, 08/XI/2011 (L. Deharveng & A. Bedos). Holotype deposited in the collections of the Museum national d'Histoire naturelle, Paris, France.

Patronym. The specific name honours Louis Deharveng and Anne Bedos of the MNHN/CNRS, Paris, who collected the specimen.

Diagnosis. Cheliceral movable finger with external distal tooth smaller than internal distal tooth. Anterior margin of carapace moderately convex, posterior margin shallowly recurved. One pair of very small lateral ocelli (see



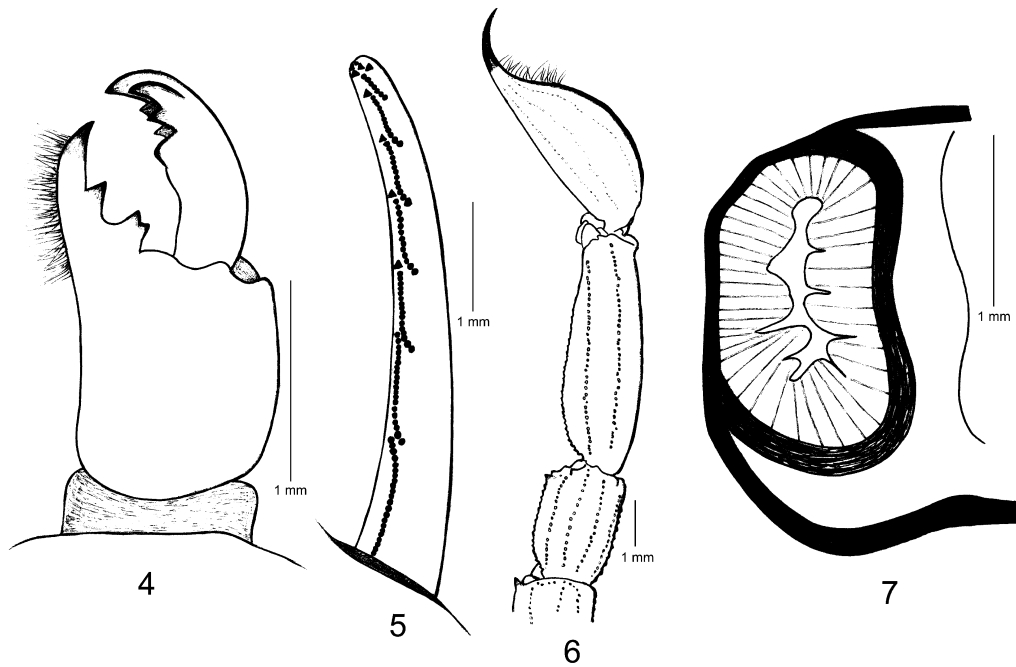
Fig. 3. Tham Nam Lot cave in the Province of Khammouane. View from inside, in the zone where the holotype was collected (photo L. Deharveng).

Lourenço 2007a, b for illustrations). One pair of circumocular sutures with a broad U-shaped configuration, but incomplete from the posterior region to median ocular tubercle. Anterosubmedian carinae absent from the zone internal to the circumocular sutures. Type D trichobothrial pattern (Soleglad & Fet 2001, 2003a) with 35 trichobothria per pedipalp: 12 on femur (six dorsal, three internal, three external), 10 on patella (three dorsal, one internal, six external, none on ventral surface), and 13 on the chela (five on manus, eight on fixed finger); pedipalp femur with dorsal trichobothria in beta (β) configuration. Pectines with 14–14 teeth; pectinal peg sensillae probably similar to those of *T. steineri*, however, observations based on scanning electron microscopy were not possible for the new species (see Lourenço 2007b). Sternum pentagonal, type 1 (Soleglad & Fet 2003b), weakly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Telotarsi each with a pair of ventrosubmedian spinule rows. Metasomal segment V with a pair of well-developed ventrosubmedian carinae, and one well-developed ventromedian carina between ventrosubmedian carinae, continuous throughout length of segment. Dentate margins of fixed and movable fingers each with median denticle row comprising 7–7 oblique granular sub-rows. Respiratory spiracles small, oval in shape; tibial spurs present on legs III and IV; pro- and retrolateral pedal spurs present on legs I–IV. Venom glands moderately walled, simple and unfolded (Lourenço 1989; Soleglad & Fet 2003a).

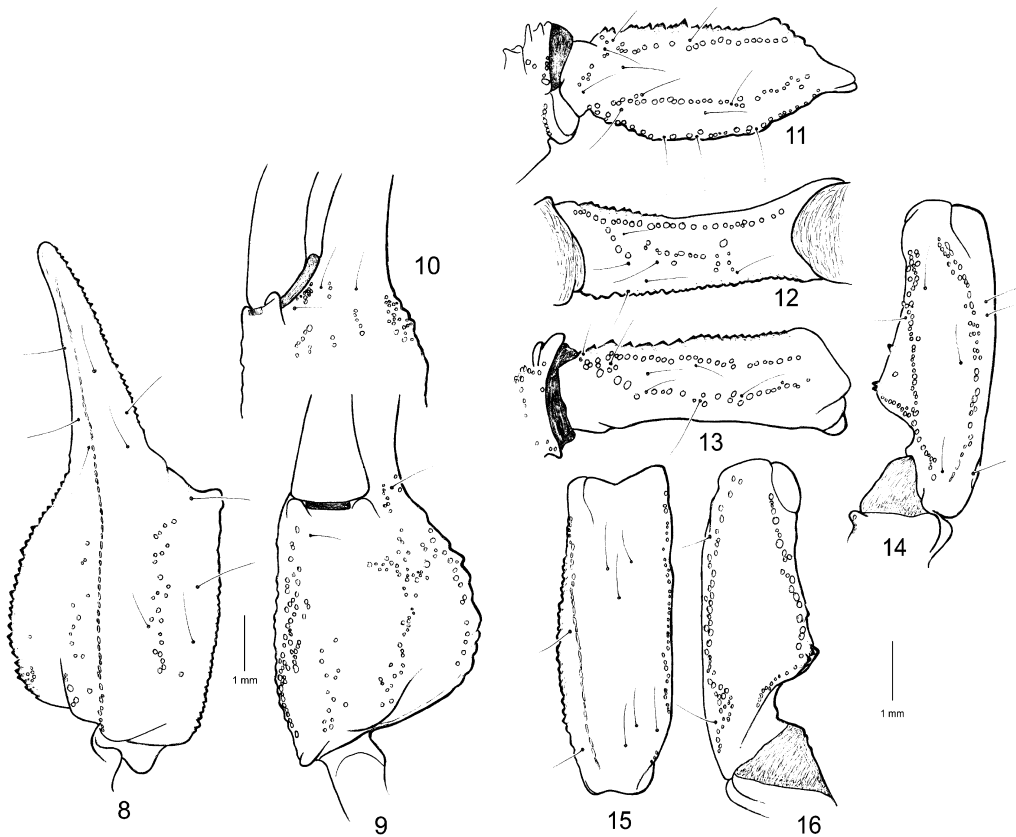
Description of female holotype (measurement after the description). *Colour.* General coloration pale-yellow to reddish-yellow; carapace and tergites with very diffused

reddish spots; pedipalps yellow with reddish zones over carinae; metasomal segments yellow to reddish-yellow; telson much paler than metasomal segment V; chelicerae, legs, coxapophysis, sternum and genital operculum yellow to pale yellow; pectines very pale, almost white.

Morphology. Dorsal edge of fixed finger of chelicera with four teeth (basal, medial, subdistal, distal), ventral edge with 5–6 denticles; dorsal edge of movable finger with three teeth (medial, subdistal, external distal), without basal teeth, ventral edge with 5–6 denticles, external distal tooth smaller than internal distal tooth. Ventral face of fingers and manus with numerous macrosetae. Carapace with anterior margin convex, posterior margin shallowly recurved, almost straight. One pair of very small lateral ocelli. Median ocular tubercle situated anteromedially, comprising a pair of median ocelli, larger than lateral ocelli, with a pair of weak, smooth superciliary carinae; interocular furrow obsolete. One pair of circumocular sutures with a broad U-shaped configuration, but incomplete in posterior region to median ocular tubercle. Anteromedian furrow shallow; posteromedian furrow shallow anteriorly, becoming slightly deeper posteriorly; posterolateral furrow shallow, weakly curved; posteromarginal furrow narrow, very shallow. Carapace moderately to strongly granulated, except on lateral and posterior margins; acarinate; anterosubmedian carinae absent from zone internal to the circumocular sutures. Pedipalp segments almost apilose, sparsely covered in short microsetae and occasional macrosetae. Femur with 5 discernable carinae; internomedian carina weak; dorsoexternal, dorsointernal, and ventrointernal carinae well-developed; externomedian carina moderate; ventromedian carina vestigial; intercarinal surfaces smooth. Patella with 6 discernable carinae; dorsoexternal, ventroexternal and ventrointernal carinae well-developed; dorsointernal carina well-developed, granular; anterior process well-developed, comprising a pair of dorsal and ventral spinoid tubercles, the dorsal more strongly developed (these being weaker than on *T. steineri*); externomedian carina absent; intercarinal surfaces smooth. Chela with 6–7 discernable carinae; dorso-median carina absent; digital carina well-developed; ventroexternal carina well-developed; ventromedian carina obsolete, reduced to vestigial granules proximally; ventrointernal carina also obsolete, reduced to a few isolated granules; internomedian and dorsointernal carinae weakly developed, each comprising a series of isolated granules; intercarinal surfaces smooth, except for coarse granules on internal surface of manus. Dentate margins of fixed and movable fingers each with median denticle row comprising 7–7 oblique granular sub-rows; each sub-row comprising several small granules and a large proximal granule. Trichobothria: Orthobothriotaxic, Type D (Soleglad & Fet 2001, 2003a), β (beta) configuration, d_2 situated on dorsal surface, d_3 and d_4 almost in the same axis, parallel and closer to dorsoexternal carina than to d_1 , angle formed by d_1 , d_3 and d_4 opening toward internal surface. Trichobothrial totals: femur 12 (6 dorsal, 3 internal, 3



Figs. 4–7. *Troglorrhinchanus lousanneorum* sp. n., female holotype. 4, chelicerae, dorsal aspect; 5, movable finger of pedipalp chela with subrows of granules; 6, metasomal segments III–V and telson, lateral aspect; 7, transversal cut of venom gland showing the moderately walled, simple and unfolded morphology.



Figs. 8–16. *Troglorrhinchanus lousanneorum* sp. n., female holotype. Trichobothrial pattern. 8–10, Chela, dorso-external, ventral and internal aspects; 11–13, femur, dorsal, internal and external aspects; 14–16, patella, dorsal, external and ventral aspects.

external); patella 10 (3 dorsal, 1 internal, 6 external); chela 13 (5 manus, 8 fixed finger). Tibiae of legs I and II without spurs; III and IV with spurs. Basitarsi each with a pair of pro- and retrolateral pedal spurs. Telotarsi each with a pair of ventrosubmedian rows of spinules. Sternum pentagonal, type 1 (Soleglad & Fet 2003b), weakly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Pectines each with 3 distinct marginal lamellae in female, 13–14 well-delineated median lamellae present in female. Fulcra present but reduced. Pectinal tooth count: 14–14 (female). Pectinal peg sensillae probably similar to that of *T. steineri* (see Lourenço 2007b). Genital operculum completely divided longitudinally. Genital plugs apparently absent. Mesosoma: Pre-tergites smooth and shiny. Post-tergites II–VI moderately to strongly granular, granulation becoming slightly coarser near posterior edges; VII with sparse granulation and a pair of costate granular dorsosubmedian and dorsolateral carinae, reaching posterior edge of segment. Sternites smooth, acarinate; surfaces with scattered macrosetae; distal margins each with a sparse row of macrosetae; respiratory spiracles small, oval in shape. Metasoma almost apilose. Eight carinae on segment I, 10 carinae on segments II–IV, 9 on segment V. Dorso-submedian carinae well-developed, costate granular throughout length of segments I–IV, absent on segment V; each carina terminating distally with a moderate spinoid granule on segments I–IV. Dorsolateral carinae well-developed, costate granular throughout length of segments I–V. Median lateral carinae well-developed on segments I–V. Ventrolateral carinae well-developed, but becoming obsolete proximally on segments I–II and throughout length of segments III–V. Ventrosubmedian carinae absent on segment I, weak on segment II, well-developed, granular throughout length of segments III–V. Ventromedian carina of segment V moderately to strongly marked between ventrosubmedian carinae. Intercarinal surfaces smooth. Telson vesicle smooth dorsally, with moderately marked granules laterally and ventrally; aculeus without a subaculear tubercle ventrally. Venom glands moderately walled, simple and unfolded (Lourenço 1989; Soleglad & Fet 2003a).

Geographic distribution. Only known from the type locality.

Relationships. The new species is very similar to the only other known species of the genus, *Troglokhammouanus steineri* Lourenço 2007, described from the Tham Xe Bangfai cave, also in Laos. Nevertheless, a few differences can be observed: (i) a generally paler coloration in the new species, which is yellow to reddish-yellow, with pale yellow legs, (ii) the granulation on pedipalps and tergites is stronger in the new species, (iii) dorsal and ventral spinoid tubercles of pedipalp patella weaker than on *T. steineri*, (iv) some morphometric values differ between the two species, although their overall size is almost identical.

Furthermore, the two species were found in separate

caves that are not connected.

Comparative morphometric values (in mm) of the female holotypes of *Troglokhammouanus steineri* and *Troglokhammouanus louisanneorum* sp. n. Total length 39.1/38.2. Carapace: length 5.3/5.6; anterior width 3.0/3.1; posterior width 5.4/5.2. Mesosoma length 11.2/9.3. Metasomal segments: I, length 2.0/1.9, width 2.9/2.9; II, length 2.2/2.3, width 2.6/2.5; III, length 2.5/2.6, width 2.5/2.5; IV, length 3.1/3.4, width 2.3/2.3; V, length 5.9/6.3, width 2.3/2.4, depth 2.1/2.1. Telson length 6.9/6.8; vesicle length 4.9/4.8, width 2.6/2.5, depth 2.3/2.1. Pedipalp: femur length 5.1/5.4, width 2.0/2.2; patella length 5.5/5.4, width 2.1/2.2; chela length 8.9/9.1, width 3.3/3.5, depth 2.6/2.8; movable finger length 5.1/5.0.

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